PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference ER03-001WO	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP 03/14809	International filing date *(day/month/year)* 23.12.2003	Priority date *(day/month/year)* 23.12.2003
International Patent Classification (IPC) or both national classification and IPC INV. H04Q7/38		
Applicant TELEFONAKTIEBOLAGET LM ERICSSON et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 10 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand 16.06.2005	Date of completion of this report 14.03.2006
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Harrysson, A Telephone No. +49 89 2399-7529

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP 03/14809

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

6-18, 20	as originally filed
1-5, 19	filed with telefax on 10.11.2005

Claims, Numbers

1-17	filed with telefax on 10.11.2005

Drawings, Sheets

1/9-9/9	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-17
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-17
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-17
	No:	Claims	

2. Citations and explanations

   see separate sheet

A **Concerning point V (reasoned statement)**

1) **Claim 1** defines a cellular communication system controlling a configuration of radio links. According to **claim 1**, a change command for changing the configuration of radio links at a selected future time code is transferred between a network controller, base stations and mobile units.

The closest prior art document represented by **D1 (US 2003/0003919 A)** discloses a method to relocate a Serving Radio Network Subsystem (SRNS) function from a source RNC to a target RNC in a UMTS network. According to **D1** the target RNC executes a "synchronized radio link reconfiguration commit procedure" which utilizes a "radio link reconfiguration commit message" which carries, an indication of a time at which both a target RNC and a Node-B will start to use a new transport bearer (see D1, section [0087]).

Claim 1 differs from **D1** in that said claim defines determining a prepared reconfiguration period which starts at the transmission time code of a reconfiguration command and ends at the selected future time code and further adding an indicator of said prepared reconfiguration period to the change command (confer the characterising part of claim 1).

The claimed invention has the **advantage** that by adding the prepared reconfiguration period indicator any communication device engaging in other changes is made aware of an ongoing reconfiguration process, and is enabled to act accordingly. Further, change commands can be issued at any time to any communication element in the network, irrespective of an ongoing reconfiguration process between already involved communication elements (confer pages 5-6 of the description).

D2 (US-B-6 570 872) discloses a method of coordinating connection changes in a distributed switch wherein messages including a target time T at which connection reconfiguration will occur are sent and wherein T may not be selected at a time farther away in the future than the period of a cyclic time counter.

However, neither D1 nor D2 discloses the transmission of a period indicator indicating the transmission time code of the reconfiguration command and a future

time code for the reconfiguration. Further, no hint causing the skilled person to seek a solution providing the above mentioned advantages can be found in any of the documents. Document D2 is not even in the field of radio communication networks and radio links.

Thus, the claimed technique is neither known, nor rendered obvious by the prior art documents cited in the International Search Report. **Claim 1** meets the requirements of Article 33(1)-(4) PCT with regard to novelty and inventive step.

2) Similar comments to the above apply also to independent **claim 8,** which defines a method of controlling a mobile unit or a base station in the cellular communication system as claimed in claim 1, **claim 11,** which defines a mobile unit for use in a cellular communication system as claimed in claim 1, **claim 14,** which defines a device for controlling a base station in as cellular communication system as claim 1 and **claim 17,** which defines a computer program product for controlling reconfiguration in the cellular communication systems claimed in claim 1. **Claims 8, 11, 14 and 17** also meets the requirements of Article 33(1)-(3) PCT with regard to novelty and inventive step.

3) Dependent **claims 2-7, 9-10, 12-13 and 15-16** all relate to further implementing details of the subject-matter defined by the claims to which they are appended, and thus also meets the requirements of Article 33(1)-(3) PCT with regard to novelty and inventive step.

4) **All** examined claims on file are considered **industrially applicable** in the sense of Article 33(1), (4) PCT.

B **Further remarks made in respect of the present application**

Claim 8 should not be divided in two-part form since such a division has already been made in claim 1 to which claim 8 makes a reference and whose features limit the scope of claim 8. The passage "characterized in that" in said claim 8 should thus have been omitted.

CONTROLLING RECONFIGURATION IN A CELLULAR COMMUNICATION SYSTEM.

The invention relates to a cellular communication system, the system accommodating communication and controlling a configuration of radio links in a radio network comprising a network controller, mobile units and base stations, the system being arranged for maintaining, in the mobile unit and in the base station, a synchronization counter indicating time codes for synchronization of functions across the system, transferring messages between the network controller, the base stations and the mobile units, the messages being transmitted at a transmission time code, the messages including a change command for changing the configuration of radio links, and a reconfiguration command for changing a current configuration state of the configuration of radio links to a next configuration state of the configuration of radio links at a selected future time code, which configuration change involves at least one mobile unit and at least one base station.

The invention further relates to a method of controlling a mobile unit or a base station in the cellular communication system, the method comprising maintaining a synchronization counter indicating time codes for synchronization of functions across the system, and transferring the messages between the mobile unit and the base stations.

The invention further relates to a mobile unit for use in a cellular communication system, the mobile unit comprising a synchronization counter indicating time codes for synchronization of functions across the system, and means for transferring the messages between the mobile unit and the base stations.

The invention further relates to a device for controlling a base station in a cellular communication system, the device comprising a synchronization counter indicating time codes for synchronization of functions across the system, and means for transferring the messages between the base station and mobile units.

The invention further relates to a computer program product for controlling reconfiguration in a cellular communication system.

Cellular communication systems are widely known for mobile communication, for example in the GSM telecommunication system and the UMTS system. The UMTS system is a wideband code division multiple access (WCDMA) system according to an ITU standard derived from code-division multiple access (CDMA), and is officially known as IMT-2000 direct spread. WCDMA is a third-generation (3G) mobile wireless technology offering

much higher data speeds to mobile and portable wireless devices than commonly offered in today's market. WCDMA can support mobile/portable voice, images, data, and video communications at up to 2 Mbps (local area access) or 384 Kbps (wide area access). The input signals are digitized and transmitted in coded, spread-spectrum mode over a broad range of frequencies. A 5 MHz-wide carrier is used, compared with 200 kHz-wide carrier for narrowband CDMA. Further detailed description of the WDCMA system can be found in the (proposed) technical standardization documents for the UMTS system, e.g. in the document NBAP TS 25.433 available from the website of the 3G partnership project (http://www.3gpp.org/).

An example of configuration control in a radio network telecommunication system is known from the patent application WO01/41492. A telecommunications system employing WCDMA technology is described, which utilizes compressed mode techniques to allow a mobile station to take measurements on another frequency in preparation for inter-frequency transfer. The configuration of the radio links, i.e. the selected transmission mode, coding, frequency, bandwidth, etc., has to be known both to the transmitter and to the receiver. For controlling the configuration of the radio links the assumption was that the compressed mode characteristics in a transmission slot were controlled by the network, but such control leads to problems when one considers that the slot characteristics are very dependent upon the mobile station characteristics. In the document, the control of the slot specifications are dictated by the mobile station to the network and acknowledged by the network to the mobile station. Thereafter, the network informs the WCDMA base station of the slot specifications, which are then imposed from the WCDMA base station to the mobile station. Once the mobile station receives the slot from the WCDMA base station, the mobile station is confident that the slot will conform to the characteristics that the mobile station needs in order to make the appropriate measurements.

It is to be noted that in general configuration changes, for example adding a radio link, may be effected directly by issuing change commands. However, for complex changes of the configuration such as compressed mode, there is a need for a time interval between the network deciding that a next configuration state is to be set, and the actual activation of the next configuration. In particular several involved communication elements (mobile units and/or base stations), which are operating according to a current configuration state, need to be informed of the upcoming change, because they need some time to prepare for the next configuration state.

In the existing UMTS system, there is, according to NBAP TS 25.433, provided a reconfiguration process to engage a next configuration state at a selected future time. A synchronization time counter is maintained in the communication elements, indicating

time codes for synchronizing configuration changes and further time-dependent functions. However, after the involved communication elements have been informed about the reconfiguration process, further configuration changes, which relate to communication elements in the system that are not aware of the reconfiguration process, have to be postponed until after said selected future time.

It is noted that document US2003/0003919 describes reconfiguration of a radio communication system. In the system a relocation procedure comprises a relocation request communicating step; a new transport bearer establishing step; a relocation triggering step; and a bearer switching step. In the relocation request communication step, the target radio network controller is notified that a reconfiguration is requested. In the new transport bearer establishing step, a new transport bearer is established between the target radio network controller and a base station. In the relocation triggering step, a relocation execution trigger message is sent from the source radio network controller to the target radio network controller. In the bearer switching step, a switch occurs from the old transport bearer to the new transport bearer. It is described to include, in the reconfiguration message, an indication of a time at which the devices will start to use the new configuration.

Therefore it is an object of the invention to provide reconfiguration control in the cellular communication system that flexibly allows further changes during the reconfiguration process.

According to a first aspect of the invention the object is achieved with a system as described in the opening paragraph, further arranged for determining a prepared reconfiguration period, which period starts at the transmission time code of the reconfiguration command, and ends at the selected future time code, and adding a prepared reconfiguration period indicator to the change command.

According to a second aspect of the invention the object is achieved with a method of controlling a mobile unit or a base station in a cellular communication system as described in the opening paragraph, the method further comprising detecting the prepared reconfiguration period indicator from the change command, and, in the event that the future selected time code has not yet passed, subsequently at the future selected time code setting the configuration according to the next configuration state.

According to a third aspect of the invention the object is achieved with a mobile unit for use in a cellular communication system as described in the opening paragraph, the mobile unit further comprising reconfiguration means for detecting the prepared reconfiguration period indicator from the change command, and for, in the event that the future selected time code has not yet passed, subsequently at the future selected time code setting the configuration according to the next configuration state.

According to a fourth aspect of the invention the object is achieved with a device for controlling a base station in a cellular communication system as described in the opening paragraph, the device further comprising reconfiguration means for detecting the prepared reconfiguration period indicator from the change command, and, in the event that the future selected time code has not yet passed, subsequently at the future selected time code setting the configuration according to the next configuration state.

The effect of the measures is that communication elements in the radio network that are receiving the change commands are aware of the upcoming reconfiguration, and are enabled to monitor the prepared reconfiguration period using the synchronization counter. This has the advantage that change commands can be issued at any time to any communication element in the network, irrespective of an ongoing reconfiguration process between already involved communication elements. This is in particular advantageous if a new communication element is to be included in an existing radio link configuration, for example a base station to be added while a communication radio link between a mobile unit and a different base station is already established and in a reconfiguration process.

presence of the field depends also on a condition "C-CPM" 83. The condition is true if the RLSR is send during compressed mode and in a prepared reconfiguration period, i.e. a reconfiguration period for stopping the compressed mode. It is noted that, alternatively, a single CFN parameter and a separate flag could be used to indicate the difference between starting and stopping a special configuration of which special configuration parameters are also included in the message.

In an embodiment the reconfiguration period indicator is selectively added to the change command for a mobile unit or base station not involved in the configuration change when issuing the reconfiguration command.

Figure 9 shows a reconfiguration process and a change command for a not involved communication element. A radio network controller RNC initiates, at CFN=5, a reconfiguration command 91, which is confirmed by a first base station RBS1 and further send to an involved mobile unit UE via a message 92. Hence a prepared reconfiguration period starts at CFN=5. However a second base station, which is not yet involved in the communication with UE, is not aware of the upcoming reconfiguration. At a later time, CFN=30, a radio link setup request RLSRq 93, e.g. as described above with reference to Figure 8, is send to RBS2. Due to the prepared reconfiguration period indicator 81 in the RLSRq, the RBS2 is aware that the prepared reconfiguration period is not yet passed. RBS2 sends a radio link setup response RLSRp message 94 to the RNC, and starts communication in uncompressed mode (UCM) 95 to the UE. Advantageously there is no need to wait. All communication elements switch to compressed mode (CM) 96 when the actual CFN is equal to the future selected time at CFN=55. It is noted that the second base station is communicating to the UE at the same frequencies as the first base station, and the UE receives both transmissions when going from the area of RBS1 to RBS2, which is also known as soft handover.

Figure 10 shows a mobile unit and a base station. A mobile unit 100 has a transmitter/receiver 110 providing a radio link 113 to a transmitter/receiver 114 in a base station 101. The transmitter/receivers 110,114 are provided with the usual radio transmission and receiving circuits, and with controller units for generating the messages to be transmitted and analyzing messages to be received as described above. The mobile unit has a synchronization counter 111, which is incremented at a predefined rate, and is

NEW CLAIMS

1. Cellular communication system, the system accommodating communication and controlling a configuration of radio links in a radio network comprising a network controller (14), mobile units (100) and base stations (101), the system being arranged for:
- maintaining, in the mobile unit and in the base station, a synchronization counter (111,116) indicating time codes for synchronization of functions across the system,
- transferring messages between the network controller, the base stations and the mobile units, the messages being transmitted at a transmission time code, the messages including
- a change command for changing the configuration of radio links, and
- a reconfiguration command for changing a current configuration state of the configuration of radio links to a next configuration state of the configuration of radio links at a selected future time code, which configuration change involves at least one mobile unit and at least one base station, characterized in that the system is further arranged for
- determining a prepared reconfiguration period (67), which period starts at the transmission time code of the reconfiguration command, and ends at the selected future time code, and
- adding a prepared reconfiguration period indicator (66) to the change command.

2. System as claimed in claim 1, wherein the synchronization counter (111,116) has a synchronization cycle indicated by a limited number of the time codes, and the change command comprises a reference time code for providing a reference time in the synchronization cycle, and the prepared reconfiguration period indicator (66) is indicating that the reference time code is indicating the selected future time code.

3. System as claimed in claim 1 or 2, wherein the prepared reconfiguration period indicator (66) comprises the transmission time code of the reconfiguration command.

4. System as claimed in claim 1, 2 or 3, wherein the prepared reconfiguration period indicator (66) is selectively added to the change command in the event that a change command is to be transferred in the prepared reconfiguration period (67).

5. System as claimed in claim 1, 2, 3 or 4, wherein the prepared reconfiguration period indicator (66) is selectively added to the change command for a mobile unit or base station not involved in the configuration change when issuing the reconfiguration command.

6. System as claimed in claim 1, 2, 3, 4 or 5, wherein the change command is a link change command (62) for adding a radio link to the configuration.

7. System as claimed in claim 1, 2, 3, 4, 5 or 6, wherein the changing the current configuration state to the next configuration state comprises changing a compressed transmission mode (63) in a radio link.

8. Method of controlling a mobile unit or a base station in the cellular communication system as claimed in any of the claims 1 to 7, the method comprising
- maintaining a synchronization counter (111,116) indicating time codes for synchronization of functions across the system, and
- transferring the messages between the mobile unit and the base stations,
characterized in that the method further comprises
- detecting the prepared reconfiguration period indicator (66) from the change command,
- and, in the event that the future selected time code has not yet passed, subsequently at the future selected time code setting the configuration according to the next configuration state.

9. Method as claimed in claim 8, wherein the method comprises, in the event that the future selected time code has not yet passed, executing the change command according to the current configuration state, and, in the event that the future selected time code has passed, executing the change command according to the next configuration state.

10. Method as claimed in claim 8 or 9, wherein the synchronization counter (111) has a synchronization cycle indicated by a limited number of the time codes, and the change command comprises a reference time code for providing a reference time in the synchronization cycle, and the prepared reconfiguration period indicator (66) is indicating that the reference time code is indicating the selected future time code, and

the method comprises, for detecting whether a current time code has passed the future selected time code, detecting whether the current time code is in a part of the synchronization cycle covered by the prepared reconfiguration period (67).

11. Mobile unit for use in a cellular communication system, as claimed in any of the claims 1 to 7, the mobile unit comprising
- a synchronization counter (111) indicating time codes for synchronization of functions across the system, and
- means (110) for transferring the messages between the mobile unit and the base stations,
characterized in that the mobile unit further comprises reconfiguration means (112) for detecting the prepared reconfiguration period indicator (66) from the change command, and for, in the event that the future selected time code has not yet passed, subsequently at the future selected time code setting the configuration according to the next configuration state.

12. Mobile unit as claimed in claim 11, wherein the reconfiguration means (112) are arranged for, in the event that the future selected time code has not yet passed, executing the change command according to the current configuration state, and for, in the event that the future selected time code has passed, executing the change command according to the next configuration state.

13. Mobile unit as claimed in claim 11 or 12, wherein the synchronization counter (111) has a synchronization cycle indicated by a limited number of the time codes, and the change command comprises a reference time code for providing a reference time in the synchronization cycle, and the prepared reconfiguration period indicator is indicating that the reference time code is indicating the selected future time code, and the reconfiguration means (112) are arranged for, in order to detect whether a current time code has passed the future selected time code, detecting whether the current time code is in a part of the synchronization cycle covered by the prepared reconfiguration period.

14. Device for controlling a base station in a cellular communication system as claimed in any of the claims 1 to 7, the device comprising
- a synchronization counter (116) indicating time codes for synchronization of functions across the system, and

- means (114) for transferring the messages between the base station and mobile units,

characterized in that the device further comprises reconfiguration means (115) for detecting the prepared reconfiguration period indicator (66) from the change command, and, in the event that the future selected time code has not yet passed, subsequently at the future selected time code setting the configuration according to the next configuration state.

15. Device as claimed in claim 14, wherein the reconfiguration means (115) are arranged for, in the event that the future selected time code has not yet passed, executing the change command according to the current configuration state, and for, in the event that the future selected time code has passed, executing the change command according to the next configuration state.

16. Device as claimed in claim 14 or 15, wherein the synchronization counter (116) has a synchronization cycle indicated by a limited number of the time codes, and the change command comprises a reference time code for providing a reference time in the synchronization cycle, and the prepared reconfiguration period indicator is indicating that the reference time code is indicating the selected future time code, and the reconfiguration means (115) are arranged for, in order to detect whether a current time code has passed the future selected time code, detecting whether the current time code is in a part of the synchronization cycle covered by the prepared reconfiguration period.

17. Computer program product for controlling reconfiguration in the cellular communication system as claimed in any of the claims 1 to 7, which program is operative to cause a processor to perform the method as claimed in any of the claims 8 to 13.